CLAIMS:

We claim:

1. A woven fiber-containing substrate with a first surface and a second surface having integral microscopic surface structures upon at least a portion of at least one of its surfaces, wherein said integral microscopic surface structures have projections substantially normal to the plane of said fiber-containing substrate, said at least one surface comprised of:

(a) portions having a plurality of substantially unbroken fibers comprising surface structures along at least part of the length of said fibers, and wherein said fibers have a Roughness Factor greater than or equal to about 1.10; and

(b) a chemical mixture, said chemical mixture comprising:

(i) a fluorocarbon-containing repellent component,

(ii) a particulate component, and

(iii) a crosslinking component;

wherein said woven fiber-containing substrate exhibits substantially durable water repellency following washing, said water repellency being at least about 5 when tested according to the 3M Water Repellency Test II (May 1992).

2. The fiber-containing substrate of claim 1 wherein said integral microscopic surface structures have a size less than about 100 µm.

3. The fiber-containing substrate of claim 1 wherein said integral microscopic surface structures are present upon at least 10% of at least of one of its surfaces.

4. The fiber-containing substrate of claim 1 wherein said integral microscopic surface structures are present upon at least 15% of at least of one of its surfaces.

5. The fiber-containing substrate of claim 1 wherein said integral microscopic surface structures are present upon at least 20% of at least of one of its surfaces.

6. The woven fiber-containing substrate of claim 1 wherein said fluorocarbon-containing repellent component is comprised of a fluoroacrylate material.

7. The woven fiber-containing substrate of claim 1 wherein said particulate component is comprised of particles having an average particle size between about 1 nm and about 50 μm.

8. The woven fiber-containing substrate of claim 1 wherein said particulate component is comprised of particles having an average particle size between about 5 nm and about 1 μm.

9. The woven fiber-containing substrate of claim 1 wherein said particulate component is comprised of particles having an average particle size between about 10 nm and about 50 nm.

10. The fiber-containing substrate of claim 7 wherein said particulate component is comprised of at least one material selected from the group consisting of silicates, doped silicates, minerals, silicas, polymers, carbon, graphite, metal salts, metal powders, silica-coated metal powders, inorganic oxides, and combinations thereof.

11. The woven fiber-containing substrate of claim 10 wherein said particulate component is comprised of a silica-based material.

12. The fiber-containing substrate of claim 11 wherein said silica-based material is colloidal silica.

13. The woven fiber-containing substrate of claim 1 wherein said crosslinking component is comprised of a polyurethane-based material.

14. The fiber-containing substrate of claim 1 wherein said fibers have a Roughness Factor greater than or equal to about 1.20.

15. The fiber-containing substrate of claim 1 wherein said fibers have a Roughness Factor greater than or equal to about 1.30.

16. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits oil repellency of at least about 5 when tested according to AATCC Test Method 118-2000.

17. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a spray rating of 100 when tested according to AATCC Test Method 22-2000.

18. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a Dynamic Rolling Angle (DRA) of less than or equal to about 10.0 degrees.

19. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a spray rating of at least 70 after 1 home wash when tested according to AATCC Test Method 22-2000.

20. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a spray rating of at least 70 after 5 home washes when tested according to AATCC Test Method 22-2000.

21. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a spray rating of at least 70 after 10 home washes when tested according to AATCC Test Method 22-2000.

22. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a spray rating of at least 60 after 20 home washes when tested according to AATCC Test Method 22-2000.

23. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a Dynamic Rolling Angle of less than or equal to about 13.0 degrees after 1 home wash.

24. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a Dynamic Rolling Angle of less than or equal to about 28.0 degrees after 5 home washes.

25. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a Dynamic Rolling Angle of less than or equal to about 35.0 degrees after 10 home washes.

26. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a Dynamic Rolling Angle of less than about 34.5 degrees after 20 home washes.

27. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a spray rating of at least 70 after exposure to 2000 Martindale abrasion cycles when tested according to AATCC Test Method 22-2000.

28. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a spray rating of at least 70 after exposure to 5000 Martindale abrasion cycles when tested according to AATCC Test Method 22-2000.

29. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a spray rating of at least 60 after exposure to 10000 Martindale abrasion cycles when tested according to AATCC Test Method 22-2000.

30. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a spray rating of at least 50 after exposure to 20000 Martindale abrasion cycles when tested according to AATCC Test Method 22-2000.

31. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a Dynamic Rolling Angle of at less than or equal to 28.0 degrees after exposure to 2000 Martindale abrasion cycles.

32. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a Dynamic Rolling Angle of at less than or equal to 35.0 degrees after exposure to 5000 Martindale abrasion cycles.

33. The woven fiber-containing substrate of claim 1 wherein said substrate exhibits a Dynamic Rolling Angle of at less than or equal to 21.5 degrees after exposure to 10000 Martindale abrasion cycles.

34. A method of making a fiber-containing substrate with a first surface and a second surface having integral microscopic surface structures upon at least a portion of at least one of its surfaces, wherein said integral microscopic surface structures have projections substantially normal to the plane of said fiber-containing substrate, said at least one surface comprised of:

(i) portions having a plurality of substantially unbroken fibers comprising surface structures along at least part of the length of said fibers, and wherein said fibers have a Roughness Factor greater than or equal to about 1.10;

comprising the steps of :

(a) providing a fiber-containing substrate, said substrate having a first surface and a second surface; and

(b) face-finishing at least said first surface of said substrate, thereby forming integral microscopic surface structures upon said first surface.

35. The method of claim 34 wherein said face-finishing of step (b) is achieved by mechanical treatment, chemical treatment, or combinations thereof.

36. The method of claim 35 wherein said face-finishing of step (b) is achieved by mechanical treatment.

37. The method of claim 36 wherein said mechanical treatment is accomplished by exposing at least said first surface to one or more abrasive surfaces.

38. The method of claim 37 wherein said one or more abrasive surfaces are coated with diamond grit or sandpaper.

39. The method of claim 38 wherein said abrasive surfaces are coated with diamond grit having an average grit size of between about 600 and about 1200.

40. The method of claim 39 wherein said abrasive surfaces are comprised of one or more abrasive cylindrical rolls.

41. A method of making a fiber-containing substrate with a first surface and a second surface having integral microscopic surface structures upon at least a portion of at least one of its surfaces, wherein said integral microscopic surface structures have projections substantially normal to the plane of said fiber-containing substrate, said at least one surface comprised of:

(i) portions having a plurality of substantially unbroken fibers comprising surface structures along at least part of the length of said fibers, and wherein said fibers have a Roughness Factor greater than or equal to about 1.10;

comprising the steps of:

(a) providing a fiber-containing substrate, said substrate having a first surface and a second surface;

(b) face-finishing at least said first surface of said substrate, thereby forming integral microscopic surface structures upon said first surface; and

(c) applying a chemical mixture to at least said first surface of said substrate, said chemical mixture comprising a repellent component.

42. The method of claim 41 wherein said face-finishing of step (b) is achieved by mechanical treatment, chemical treatment, or combinations thereof.

43. The method of claim 42 wherein said face-finishing of step (b) is achieved by mechanical treatment.

44. The method of claim 43 wherein said mechanical treatment is accomplished by exposing at least said first surface to one or more abrasive surfaces.

45. The method of claim 44 wherein said one or more abrasive surfaces are coated with diamond grit or sandpaper.

46. The method of claim 45 wherein said abrasive surfaces are coated with diamond grit having an average grit size of between about 600 and about 1200.

47. The method of claim 46 wherein said abrasive surfaces are comprised of one or more abrasive cylindrical rolls.

48. A method of making a fiber-containing substrate with a first surface and a second surface having integral microscopic surface structures upon at least a portion of at least one of its surfaces, wherein said integral microscopic surface structures have projections substantially normal to the plane of said fiber-containing substrate, said at least one surface comprised of:

(i) portions having a plurality of substantially unbroken fibers comprising surface structures along at least part of the length of said fibers, and wherein said fibers have a Roughness Factor greater than or equal to about 1.10;

comprising the steps of :

(a) providing a fiber-containing substrate, said substrate having a first surface and a second surface;

(b) face-finishing at least said first surface of said substrate, thereby forming integral microscopic surface structures upon said first surface; and

(c) applying a chemical mixture to at least said first surface, said chemical mixture comprising a repellent and a particulate component.

49. The method of claim 48 wherein said face-finishing of step (b) is achieved by mechanical treatment, chemical treatment, or combinations thereof.

50. The method of claim 49 wherein said face-finishing of step (b) is achieved by mechanical treatment.

51. The method of claim 50 wherein said mechanical treatment is accomplished by exposing at least said first surface to one or more abrasive surfaces.

52. The method of claim 51 wherein said one or more abrasive surfaces are coated with diamond grit or sandpaper.

53. The method of claim 52 wherein said abrasive surfaces are coated with diamond grit having an average grit size of between about 600 and about 1200.

54. The method of claim 53 wherein said abrasive surfaces are comprised of one or more abrasive cylindrical rolls.

55. A method of making a fiber-containing substrate with a first surface and a second surface having integral microscopic surface structures upon at least a portion of at least one of its surfaces, wherein said integral microscopic surface structures have projections substantially normal to the plane of said fiber-containing substrate, said at least one surface comprised of:

(i) portions having a plurality of substantially unbroken fibers comprising surface structures along at least part of the length of said fibers, and wherein said fibers have a Roughness Factor greater than or equal to about 1.10;

comprising the steps of :

(a) providing a fiber-containing substrate, said substrate having a first surface and a second surface;

(b) face-finishing at least said first surface of said substrate, thereby forming integral microscopic surface structures upon said first surface;

(c) applying a first chemical mixture to at least said first surface, said first chemical mixture comprising a particulate component; and

(d) subsequently applying a second chemical mixture to at least said first surface, said second chemical mixture comprising a repellent component.

56. The method of claim 55 wherein said face-finishing of step (b) is achieved by mechanical treatment, chemical treatment, or combinations thereof.

57. The method of claim 56 wherein said face-finishing of step (b) is achieved by mechanical treatment.

58. The method of claim 57 wherein said mechanical treatment is accomplished by exposing at least said first surface to one or more abrasive surfaces.

59. The method of claim 58 wherein said one or more abrasive surfaces are coated with diamond grit or sandpaper.

60. The method of claim 59 wherein said abrasive surfaces are coated with diamond grit having an average grit size of between about 600 and about 1200.

61. The method of claim 60 wherein said abrasive surfaces are comprised of one or more abrasive cylindrical rolls.

62. A method of making a fiber-containing substrate with a first surface and a second surface having integral microscopic surface structures upon at least a portion of at least one of its surfaces, wherein said integral microscopic surface structures have projections substantially normal to the plane of said fiber-containing substrate, said at least one surface comprised of:

(i) portions having a plurality of substantially unbroken fibers comprising surface structures along at least part of the length of said fibers, and wherein said fibers have a Roughness Factor greater than or equal to about 1.10;

comprising the steps of :

(a) providing a fiber-containing substrate, said substrate having a first surface and a second surface;

(b) face-finishing at least said first surface of said substrate, thereby forming integral microscopic surface structures upon said first surface;

(c) applying a first chemical mixture to at least said first surface, said first chemical mixture comprising a repellent component; and

(d) subsequently applying a second chemical mixture to at least said first surface, said second chemical mixture comprising a repellent component and a particulate component.

63. The method of claim 62 wherein said face-finishing of step (b) is achieved by mechanical treatment, chemical treatment, or combinations thereof.

64. The method of claim 63 wherein said face-finishing of step (b) is achieved by mechanical treatment.

65. The method of claim 64 wherein said mechanical treatment is accomplished by exposing at least said first surface to one or more abrasive surfaces.

66. The method of claim 65 wherein said one or more abrasive surfaces are coated with diamond grit or sandpaper.

67. The method of claim 66 wherein said abrasive surfaces are coated with diamond grit having an average grit size of between about 600 and about 1200.

68. The method of claim 67 wherein said abrasive surfaces are comprised of one or more abrasive cylindrical rolls.

69. A method of making a composite textile substrate comprising the steps of:

(a) providing at least one layer of a fiber-containing substrate with a first surface and a second surface having integral microscopic surface structures upon at least a portion of at least one of its surfaces, wherein said integral microscopic surface structures have projections substantially normal to the plane of said fiber-containing substrate, said at least one surface comprised of:

(i) portions having a plurality of substantially unbroken fibers comprising surface structures along at least part of the length of said fibers, and wherein said fibers have a Roughness Factor greater than or equal to about 1.10;

(b) providing at least one additional layer of material selected from the group consisting of fiber-containing substrates, films, coatings, foams, reinforcing substrates, and adhesives; and

(c) joining the layers of step (a) and step (b) together.

70. The method of claim 69 wherein said joining step of (c) is achieved using adhesive, heat lamination, and combinations thereof.